MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

BST1034 – STATISTICS FOR MANAGERS

(All sections / Groups)

8 MARCH 2018
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **8** printed pages excluding the cover page, with **4** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1

a) A food delivery company has been studying the amount of time their customers need to wait for their food order to be received. The delivery time for each order on last month are summarised in the table below.

Delivery time (minutes)	Number of orders
20 but less than 30	45
30 but less than 40	87
40 but less than 50	134
50 but less than 60	94
60 but less than 70	36

(i) Compute mean, median and mode for the above data set.

(9 marks)

(ii) Describe the shape of this data set based on your answer in part (i).

(2 marks)

b) XYZ University would like to study the relationship between gender and the academic achievement of their graduates in year 2017. The university's academic department has grouped the related data as shown in the table below.

Gender	Bachelor's degree classification			
	First class	Second upper class	Second lower class	Third class
Male	74	105	97	70
Female	111	203	193	137

(i) Find the probability that the selected student is a male and he has obtained second upper class for his bachelor degree.

(2 marks)

(ii) Given that a female student is selected, what is the probability that she is a first-class graduate?

(3 marks)

(iii) Is gender and bachelor's degree classification statistically independent?

(2 marks)

c) ABC company offered dental clinic service to its employee. A recent study conducted by the human resource director showed the annual cost per employee per year has an average spent of RM 500 and standard deviation of RM 63 per year.

(i) What is the percentage of employee dental cost between RM 400 and RM 650 per year? (3 marks)

(ii) What was the cost for the 5% of employees who incurred the highest dental expenses? (4 marks)

(Total: 25 marks)

Continued.....

QUESTION 2

a) Company ABC has introduced a new scheme of pay for manual workers to rewards higher productivity. After the new pay scheme running for a few months, a random sample of manual workers was selected and the items produced per hour by them is given below:

46	41	57	63	51	50
43	65	48	54	59	47

(i) Construct a 99% confidence interval for the mean number of items produced per hour.

(6 marks)

(ii) The past record has shown that the mean number of items produced per hour by these manual workers was 48. Test whether the productivity of the manual worker has increased after the new pay scheme at 1% significance level.

(8 marks)

b) A local company owns a supermarket in the urban area and a hypermarket in the suburban area. Free parking service is provided by the hypermarket but not the supermarket. Hence, the company is interested to understand the satisfaction level of their customers towards the service provided by both supermarket and hypermarket. An interview with customers from both supermarket and hypermarket was conducted, 60 out of 100 customers from supermarket stated that they were satisfied with the service whereby 150 out of 200 customers from hypermarket stated that they were satisfied with the service. Test whether there is a significantly higher proportion of customers were satisfied with the service provided by hypermarket than supermarket at 1% level of significance.

(11 marks)

(Total: 25 Marks)

Continued.....

QUESTION 3

a) As a step in establishing their rates, an automobile insurance company is interested in determining whether there is a difference in the mean highway speeds that drivers of different age groups drive. To help answer this question, they have selected a random sample of drivers in three age categories; under 21, 21 – 50, and over 50. The engineers then recorded the drivers' speeds at a designated point on a highway in the state. The subjects were unaware that their speed was being recorded. The summary of results appears in the table below:

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Under 21	20	1489.729	74.486	79.42669
21-50	20	1415.272	70.764	44.55447
Over 50	20	1334.178	66.709	61.34031

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*
Between Groups		2		
Within Groups				
Total	4126.295	59		

(i) Complete the ANOVA table.

(7 marks)

(ii) Test at the 2.5% significance level to determine whether the mean highway speeds that drivers of different age groups drive differ.

(6 marks)

b) An article reports that smaller firms seems to be hiring more than large ones as the Four surgical procedures currently are used to install pacemakers. If the patient does not need to return for follow-up surgery, the operation is called a "clear" operation. A heart centre wants to compare the proportion of clear operations for the 4 procedures, and collects the following numbers of patients from their own records:

	Procedure				
	A	B	C	D	Total
Clear	27	41	21	7	96
Return	11	15	9	11	46
Total	38	56	30	18	142

Is there evidence that the proportion of clear operations is related to the procedures used? Test using the 5% level of significance.

(12 marks)
(Total: 25 marks)

Continued.....

QUESTION 4

a) Research has shown that the performance of a firm is mainly depends on the level of corporate governance (CG). The level of corporate governance (scale 0 – 100) and the firm performance (measured by return on equity, in percentage) of a random sample of twelve listed companies are as follows:

CG level	73	81	76	74	71	67	94	69	59	87	56	78
Firm performance	26	31	34	32	29	24	46	22	16	40	11	34

(i) Compute and interpret the coefficient of correlation.

(4 marks)

(ii) Compute and interpret the coefficient of determination.

(2 marks)

(iii) Determine the regression line of the firm performance.

(7 marks)

b) The following partially completed ANOVA table is related to the linear regression model of the firm performance, regressed on four explanatory variables:

Source of Variation	*SS*	*df*	*MS*	*F-ratio*
Regression	***	4	***	***
Residual	5320	***	***	
Total	5966	116		

(i) Complete the ANOVA table.

(4 marks)

(ii) Test whether the regression model is statistically significant at 2.5% significance level.

(8 marks)

(Total: 25 Marks)

Continued.....

APPENDIXES:

I. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Ungrouped Data:

Sample Mean, $\bar{x} = \frac{\sum x}{n}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

Grouped Data:

Sample Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$

Median $= L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1} \right)}{f_m} \right] c$ Mode $= L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}} \right] c$

B. PROBABILITY DISTRIBUTION

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq where $q = 1-p$

Normal Distribution

If $X \sim N(\mu, \sigma)$ where E(X) = μ and VAR(X) = σ^2, then $Z = \frac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

If σ known, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

If σ unknown, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$

$(100-\alpha)\%$ Confidence Interval for Population Proportion, p: $p \pm Z_{\alpha/2} \sqrt{\frac{p(1-p)}{n}}$

Sample Size Determination for Population Mean: $n = \frac{(Z_{\alpha/2})^2 \sigma^2}{E^2}$

Sample Size Determination for Population Proportion: $n = \frac{(Z_{\alpha/2})^2 p(1-p)}{E^2}$

Continued.....

D. HYPOTHESIS TESTING

One Sample Mean Test

***Z*-test:** $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$ ***t*-test:** $t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

Two Sample Mean Test

***Z*-test:** $Z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$

***t*-test:** $t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$ where $s_p = \sqrt{\dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}} \quad \text{where} = \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

E. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(X_{ij} - \bar{\bar{X}}\right)^2 \qquad SSB = \sum_{i=1}^{k} n_i\left(\bar{X}_i - \bar{\bar{X}}\right)^2$$

$$SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}(x_{ij} - \bar{x}_i)^2$$

F. CHI-SQUARE ANALYSIS

Expected cell frequencies for Independent Test: $E_i = \dfrac{Row\ total \times Column\ total}{N}$

Chi-Square test statistic: $\chi^2 = \sum \dfrac{(O_i - E_i)^2}{E_i}$

O_i = Observed frequency in a particular cell

E_i = expected frequency in a particular cell

Continued.....

G. REGRESSION ANALYSIS

Correlation Coefficient: $$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Simple Linear Regression: $Y = a + bX$ where $$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$ and

$$a = \bar{y} - b\bar{x}$$

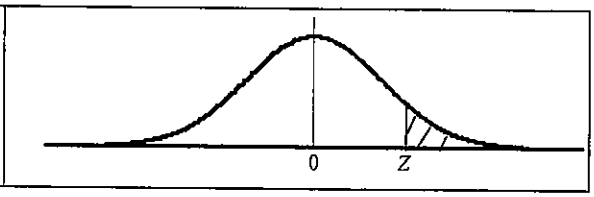
H. INDEX NUMBERS

Simple Price Index $P = \frac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Simple Aggregate Price Index $P = \frac{\sum p_t}{\sum p_0} \times 100$	**Paasche Quantity Index** $P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$
Paasche Price Index $P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

Continued.....

II. STATISTICAL TABLE

Table 1
The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

End of Page